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CRITICAL NOTES ON CERTAIN *PERO* SPECIES (LEPIDOPTERA, GEOMETRIDAE)

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At the time of its appearance, Grossbeck's "Studies of the North American geometrid genus *Pero*" (1910, Proc. U. S. Natl. Mus., vol. 38, pp. 359-377, pls. 13-16) was an excellent piece of work and served to clear up a great deal of the existing muddle regarding the identity of the closely similar species in this very difficult group. As time has progressed, however, taxonomists require more and more accurate details regarding types and type localities than were considered necessary in the early part of this century and which, in consequence, were not definitely dealt with in Grossbeck's revision. As the Grossbeck collection is now incorporated in the collection of the American Museum of Natural History and as it includes the greater part of the *Pero* material discussed by him, including types of his new species and a certain proportion of his slide material, it would seem to be of considerable value to rectify, as far as possible, some of these omissions and incidentally to correct a few unfortunate errors which the author had allowed to creep into his work.

One of the main omissions is found in the explanation of the plates where, apart from the specific name, both as regards the figures of the adults and those of the male genitalia, no further details are given to indicate the origin of the specimens which served for illustration. In the case of the adults it has been possible in virtually every instance by careful comparison to find the figured specimens in the collection. With regard to the genitalic figures the investigation was less successful; it is true that slides were found from which obviously some of the figures had been drawn, but these in most instances bore no data which

could be used in tying them up with pinned specimens and, to confuse the issue still further, there was virtually no material in the collection from which abdomens were missing. It might also be mentioned that in the drawings an important portion of the male genitalia, which seems to be a sort of subscaphium, had been entirely omitted. This is unfortunate as frequently excellent differentiating characters are found in the shape of this section.

Another stumbling block occurred when it came to designating the lectotypes of Grossbeck's new species. An examination of the various type series in the Museum collection showed that the custom of the time had been followed in labeling a "Type male" and a "Type female" and marking each of the remaining type specimens "Cotype." At some later date Grossbeck had actually attached a further label reading "lectoholotype" to the male type. This action would seem to settle the issue very satisfactorily if it were not for the fact that the concluding line of several of the descriptions mentions a certain type number in the United States National Museum, the corresponding specimens according to Mr. Hahn Capps being, however, merely labeled "Cotypes" and differing markedly in locality labels from the "types" in the American Museum collection. It is not proposed at the present time to solve this delicate nomenclatorial puzzle, especially as in all probability no change in the accepted specific identities would result. However, full details regarding localities will be supplied in the following discussion which deals with each individual species as it occurs in Grossbeck's revision.

Pero honestarius Walker

The male and female specimens figured on plate 13, figures 1 and 2, are both from Elizabeth, New Jersey, the male bearing the date August 20, and the female, August 15, and belonging therefore to the summer brood. The basal two-thirds of the primaries in the male, especially the areas before the t.p. lines, are deep black brown, and the specimens can scarcely be distinguished from one of the spurious male types of *atrocolorata* Hulst labeled "N. Y." from the Slosson collection in the American Museum of Natural History. This has at some time or other received the additional label "lectoholotype," ignoring Grossbeck's restriction on page 365 of his study. The female primaries are in

general light brown with an intensification of the shade basad of the t.p. line. It is impossible to fix a type locality for the species, as Walker's male type bore no locality data and his male type of *stygiaria*, a synonym, was simply recorded as from North America. As regards the drawing of the genitalia, a number of Grossbeck's slides with the specific name and the number 5072 have been examined. Some are without locality data, but of four slides labeled "Elizabeth, N. J." one corresponds very closely to the figure and was probably the basis for the illustration. No specimen, however, exists in the collection without abdomen, so this reference must remain indefinite.

Pero giganteus Grossbeck

The specimen figured on plate 13, figure 3, is a female "Co-type" from Provo, Utah, August 14, 1908, T. Spalding. There is no female "Type" in the collection, but the male "Type" with additional label "lectoholotype" is present and from the same locality and collector, dated August 7, 1908. Among the "Cotypes" are five females from Provo, Utah, two males and two females from Stockton, Utah, a pair from Duncan, Vancouver Island (listed as Vancouver by Grossbeck), a worn female from Kaslo, British Columbia, a rubbed female from Tacoma, Washington, a male from Chimney Gulch, Golden, Colorado, and two males from The Dalles, Oregon (listed as Dally), these last three specimens being smaller and possibly not conspecific. All these localities are given by Grossbeck, under the heading "Habitat." A good deal of the British Columbia material was probably returned to Barnes.

The male type is very similar to the figured female in maculation; the basal area of the primaries before the t.a. line is distinctly grayish; the median area is smoky brown, particularly deep on the basal side of the t.p. line, the costal area being lighter and showing slight ruddy suffusion before the thin white discal mark; the subterminal area is quite pale, almost whitish, and the terminal area slightly darker and pale olivaceous. In the female rather bright brown shades of varying intensity prevail in the median area, but the basal area is even more contrastingly grayish.

Judging by the data on the figured specimen and on the "male type" as well as by the preponderance of Utah specimens among

the author's cotypes, it might be considered that the intention of the author was to consider Utah as the type locality. However, the specimens in the United States National Museum under Type No. 13124 are a male and two females collected by Dyar on his 1903 trip to the Kootenay region of British Columbia. Should it become necessary at some time or other to split the species into racial forms there will be a difficult decision to make as to the correct type locality. It might be noted that in all probability a Cassino and Swett name is available for Utah material.

No genitalic slide material of the species could be found in the collection.

Pero peplarioides Hulst

A serious error of misidentification seems to have been made by Grossbeck with regard to this species. It was described (1900, Canadian Ent., vol. 30, p. 218) as *Marmarea peplarioides* from a presumable male collected by Kunze in the San Francisco Mountains, Arizona, on July 23, 1897, the genus *Marmarea* having been erected by Hulst (1897, Trans. Amer. Ent. Soc., vol. 23, p. 379) for *occidentalis* Hulst and distinguished from *Pero*, or *Azelina* as it was then called, by the "heavy, dentate, somewhat lamellate" male antennae as compared with the simple ciliate antennae of other species. In Dyar's list of 1902, Hulst placed it as a variety of *occidentalis*. Granting that Hulst at times made curious errors, it seems hardly likely that he would fail to recognize characters of one of his own genera, and it may therefore be presupposed that the type specimen of *peplarioides* actually possessed dentate antennae.

Turning to Grossbeck's conception of the species we find that the long series in the collection consists almost entirely of southern California specimens, mostly from the San Diego region. The male figured on plate 13, figure 4, bears no locality label but merely a date, "6-17"; it is, however, obviously a specimen from the above-mentioned locality. The female, figure 5, is from "San Diego, 4.15.09, Geo. H. Field." In the structure of the male antennae the figured male and other males in the series do not agree with Hulst's diagnosis of *peplarioides*, having simple, ciliate antennae; in fact they belong to the species later described by Cassino and Swett as *macdunnoughi*

(1922, Lepidopterist, vol. 3, p. 141), an identity that was already hinted at in a former paper (1945, Canadian Ent., vol. 77, p. 67).

As regards Grossbeck's genitalic slides, three of these have been found bearing the number 5074, and "California" as well as the specific name; one is further marked as "typical form." None of these slides can be definitely tied down to the figure given on plate 15, figure 2, which is possibly a composite drawing. However, they all agree in the general characters and, it might be noted, show the form of subscaphium noted in the 1945 paper, above mentioned, as characteristic of *macdunnoughi*. No specimens in the series are without abdomens.

Concerning the true *peplarioides* information was kindly supplied by Dr. J. B. Schmitt that the Hulst collection at Rutgers University contained no type and only a single specimen was labeled with the specific name; this on examination proved to be another *macdunnoughi* with label in Grossbeck's handwriting. In the American Museum collection a male specimen was found bearing the exact data of the original description of *peplarioides* and, further, showing distinctly serrate antennae as in *occidentalis*. Although it lacks Hulst's type label it seems extremely probable that it actually is the specimen on which the original description was based. How it came to be in the collection cannot now be ascertained and perhaps had better not be inquired into too fully. If not the type, it at least is topotypical, and it is proposed to designate it as the lectotype, as no type specimen can be located. It will fall into a group with *occidentalis* and *colorado*. A slide has been made of the genitalia, and these prove very similar to those of *occidentalis* as figured by Grossbeck. The aedeagus, however, shows no apical chitinous plate but merely a very slight knob on the left apical side when viewed ventrally. The vesica shows a small patch of fine spicules in the central area, and there are indications of still fainter ones apically. The subscaphium is broad in the apical half, somewhat bent ventrad with rounded caudal edge and a slight indication of a medio-ventral ridge; the basal half is broad, flat with a gently excavated cephalic margin. The coloration and maculation of the primaries of this lectotype are very similar to those of *macdunnoughi*, and the course of the t.a. and t.p. lines is scarcely to be distinguished, although the termination of the latter line at the inner margin appears slightly more upright. The initial portion of the t.a. line is heavily marked. There is little trace

of any ruddy suffusion preceding the pale discal mark and this is distinctly angled, although quite thin.

***Pero behrensarius* Packard**

The specimen figured on plate 13, figure 7, is a female, simply labeled "Oregon." Besides this the collection contains only two very worn specimens from the Henry Edwards' collection, a male without abdomen labeled "Sierra Nev. Cal." and a female from "Oregon." A very much broken slide with no locality label and another slide labeled "Oregon, Wright" have been found but neither can be said definitely to have formed the basis for the illustration on plate 16, figure 4. The identification of the species is correct.

***Pero occidentalis* Hulst**

The figure of this species on plate 13, figure 12, is based on a male specimen listed under "Habitat" as Sierra Nevada, California. This is from the Henry Edwards' collection and bears his number 133 on the label; this number in his original catalogue cites Alameda County, June, as the locality, a statement which is rather puzzling unless one considers the Sierran label as a sort of stock label attached to Californian species in general. As a rule the entries in the catalogue are very reliable and more likely to be correct than the rather vague labels found on specimens. Hulst's locality "California" is certainly not very illuminating, but it is quite possible that he obtained the type specimen from one or other of the San Francisco collectors, in which case Alameda County would be a more likely type locality than the mountainous region to the east. Besides the figured specimen the collection contains two more males with similar label and a pair from "Oregon." All these specimens have a distinctly yellowish brown tinge over the paler areas of the primaries probably due to age. Several fresh specimens from Marin County, collected by W. Bauer, are much deeper in color, and the brown coloration shows a faint but distinct ruddy shade. Two rather crushed slides, No. 5077, labeled "Oregon," are in the collection and one of these has undoubtedly served for the illustration on plate 16, figure 6, and has been so marked. The subscaphium shows a strong ventro-median ridge terminating in a blunt apical projection and preceded cephalad by a cluster of fine spicules.

Pero modestus Grossbeck

A long series of type material, predominantly from Arizona localities (Yavapai County; Palmerlee, Cochise County) is contained in the collection. The "type male" and "type female" are from Yavapai County, Arizona, August 10 and August 26, respectively, and are part of the material collected by Otto Buchholz in the vicinity of Prescott. The specimen figured, however, on plate 13, figure 13, is a cotype female from Glenwood Springs, Colorado, August 16-23, originally from the Barnes collection and the only specimen from this locality in the collection. This specimen is somewhat lighter brown in coloration than the Arizona type, especially in the median area, but in size and maculation matches it very closely, close enough to leave little doubt that it belongs to the same species.

Three slides have been found, No. 4748, with the label "*Azelina modestaria*." Two of these have the additional note "Arizona" and from one of these, a rather crushed preparation, the drawing has undoubtedly been made and is quite accurate except that a faint spiculate patch present in the vesica is not indicated. In the shape of what Grossbeck calls the clasper the three slides differ slightly, notably in the prominence of the so-called heel. In view of the variability of the type series in coloration it is difficult to decide whether such differences have specific value, especially as there is no positive means of associating these slides with actual male specimens, although several in the series lack abdomens. However, further slides made from the "type male" and a similarly colored "cotype" from the same locality show pretty conclusively that the slide on which the drawing was based was made from one of the Yavapai County males.

The type male and a series of six cotypes, labeled Yavapai County, all agree in showing virtually no light brown shading on the primaries in the median area, the color of this area below the cell being light smoky brown with deeper shading along the t.p. line. The costa and the area before the small discal mark are paler, inclining to ochreous with a very faint ruddy tinge. The outer section of the wing is pale olivaceous with slight smoky sprinkling. The type female and another six cotypes from the same locality show an even heavier smoky suffusion in the median area than is found in the males, but a small patch in the cell before the discal mark is generally quite definitely tinged with ruddy. A fine black terminal line, running from the median an-

gle of the wing to the tornus and thence along the inner margin almost to the t.a. line, seems to be a female characteristic as it has not been noted in the male to any great extent. In the cotype series from Palmerlee three males agree in coloration with the Prescott males; six males, however, show a light brownish suffusion over the median area and a similar coloration occurs in one male and two females from the Prescott series. Genitalic slides made from both the light and dark forms from the Palmerlee material show only the slightest differences among themselves; all, however, differ from the Yavapai material in having a less sharply defined heel portion of the "clasper." As in other respects, including the shape of the subscaphium and the octavals of the eighth ventral segment, they agree, it is probable that no particular weight should be placed on what is, after all, a very slight divergence. It might be noted that the subscaphium, viewed ventrally, shows the apical section hollowed out as usual and bending ventrad; the caudal margin is conically rounded, forming a slight median point; at the junction with the flatter posterior half is a small median tooth, at times hardly visible; there are no such strong projections as in *macdunnoughi*.

Most of the localities mentioned by Grossbeck under "Habitat" are represented in the collection by material, frequently, however, by single females. Some of this material seems rather out of place and will have to be further studied when more specimens are available. Among the Stockton, Utah, cotypes are several which would fall to the later described *grossbecki* Pearsall which may or may not be a good species. Other Stockton specimens, however, appear correctly placed under *modestus*. A few males from Fort Wingate, New Mexico (*ex* collection Barnes), not marked as cotypes, look most incongruous, the t.p. line of primaries showing a very strong incurve and being bordered outwardly by dark shading which in turn is followed by a quite broad, whitish band; the terminal area shows dark shading below the apex. In the genitalia there seems nothing very characteristic whereby the form might be distinguished from Yavapai County material except in very minor differences in the shape of the subscaphium and the octavals, but with more and better material available a distinct race or even species might be indicated.

The "Cotype" material in the United States National Museum under Type No. 13125 consists of three males from the

Argus Mountains, California, a female from "So. Ariz.," and another female from Las Vegas, New Mexico. These localities are so widespread and diversified that there is a distinct possibility that the Argus Mountain males will not agree well with the Prescott and Palmerlee material. This again brings up the unfortunate question of type restriction.

Life history studies to determine whether the species is single or double brooded are very essential to accurate specific definition; if double brooded, size and coloration of each brood may play an important role.

Pero morrisonarius Henry Edwards

This species, originally described from the state of Washington, proves to have a wide range across the entire continent. The specimen figured by Grossbeck on plate 13, figure 6, is a male from Big Indian Valley, Catskill Mountains, New York, and is correctly identified. Several slides made from western material were found in the collection and it seems probable that a specimen from Arrow Lake, British Columbia, formed the basis for the figure on plate 16, figure 7. One of the easiest characters for identification of the males is found in the large, bulging octavals which may be readily examined *in situ*. In the genitalia the terminal armature of the aedeagus and the thin nature of both portions of the clasper are diagnostic. The species is apparently single brooded, occurring in June and July.

Pero colorado Grossbeck

In a previous article a male specimen from Durango, Colorado, in the United States National Museum (*ex* collection Barnes) was rather prematurely designated as the lectotype (1945, Canadian Ent., vol. 77, p. 68), as it was erroneously assumed that all the specimens of the type series had been labeled "cotypes." It now turns out that Grossbeck's "type male" and "type female" are the specimens figured on plate 13, figures 8 and 9, both from Durango, Colorado (Barnes collection), the male with the date July 24-30, and the female, July 8-15. The series contains further a cotype male with same data as the female and another male from Glenwood Springs, Colorado, June 24-30, also from the Barnes collection. All the males show the distinctly serrate antennae mentioned in the original description.

A slide made of the genitalia of the type male does not at all

agree with Grossbeck's figure on plate 16, figure 8. It does, however, agree with a slide, kindly made by Mr. Hahn Capps, of the above-mentioned lectotype, so at least no change in the conception of the species will be necessary. In Grossbeck's slide material, a slide, No. 4272, was found labeled "*Azelina coloradensis*, Colorado" which almost certainly served as the original for the erroneous drawing, but unfortunately the specimen from which it was made was not indicated unless, indeed, it be a worn male without abdomen and with ciliate antennae from "Denver, Colorado, Barnes Collection" for which there is, of course, no definite assurance. The slide must be considered as that of *morrisonarius* or of a very closely allied form and not of *colorado*. Another slide in the collection, No. 4748, was labeled "*Azelina modestaria*, Durango, Colo. Barnes" and agrees excellently with the slide of the male type of *colorado*; the specimen from which this slide was made is not in the collection, however, although it would appear to be topotypical of *colorado*. It is not surprising that Grossbeck confused it with *modestus*, as the genitalia in the two species are extremely similar in all respects except in the shape of the subscaphium which in *colorado* shows a stronger medio-apical projection on the ventral side, continued cephalad for a short distance by a slight ridge. The small projection at the junction of the curved apical half and the flatter basal section found in *modestus* does not appear to be present in *colorado* but is replaced by a cluster of weak spicules, as in *occidentalis* but finer. It is possible that Grossbeck had not recognized the differences in the structure of the male antennae between *colorado* and *modestus* until some time after the slides had been made which would account for the erroneous labeling and for the inclusion of "Durango, Colorado" in his list of localities for *modestus*, an error he failed to rectify.

In the male genitalia *colorado* approaches very closely to the true *peplarioides*, both species lacking the small, apical, chitinous plate in the aedeagus found in *occidentalis*. The subscaphium of *peplarioides* appears to be longer and broader than that of *colorado* and the apical projection not quite so well developed, as far as can be told from the limited material available.

Pero marmoratus Grossbeck

Both male and female types are figured on plate 13, figures 10 and 11, respectively, the former from Chester, New Jersey, and

the latter from Cohasset, Massachusetts. The cotype series contains eight males, mostly from the same localities, but single specimens are present from Newton Highlands, Massachusetts, Scranton, Pennsylvania, and New Windsor, New York. Three slides of the genitalia have been found, No. 5082, one labeled Cohasset, Massachusetts. The drawing, as far as could be told, was probably made from a slide without locality label, and this has been marked accordingly. The thin aedeagus separates the species from the others discussed in the present article. The subscaphium has the apical portion drawn out ventrally into a long beak-like process. The cotype material in the United States National Museum under Type No. 13126 again differs considerably in locality from the figured specimens. It consists of a male from "Cambridge, Md. May 24," another male labeled "Pa.," and a third male without locality. A single female from Washington, D. C., is also represented.

